Stats 4CI3 - Assignment 2

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Question 1:

a)

20 random numbers between 0 and 1.

```
set.seed(1683)
runif(20)
```

```
 [1] 0.89935750 0.34673937 0.20192327 0.50306112
 [5] 0.03429885 0.47599193 0.02117247 0.72235509
 [9] 0.81144084 0.39086341 0.66655870 0.71707646
[13] 0.23924771 0.57705529 0.34018814 0.85164614
[17] 0.56241754 0.05167353 0.61855184 0.53018272
```

50 random numbers between 1 and 75.

```
set.seed(1683)
runif(50,1,75)
```

```
 [1] 67.552455 26.658713 15.942322 38.226523  3.538115
 [6] 36.223403  2.566763 54.454277 61.046622 29.923892
[11] 50.325344 54.063658 18.704330 43.702092 26.173923
[16] 64.021814 42.618898  4.823841 46.772836 40.233521
[21] 69.458248 50.958407 64.466573 56.684589 67.786029
[26] 37.063143 40.695823 31.070972 28.126110 36.952971
[31] 67.512106  8.526618 41.238801  4.903175 11.061298
[36] 18.260056 11.396470 30.722881 46.514434 71.529648
[41] 49.307700 74.553591 24.953776 12.830437 19.746936
[46] 25.061652 61.994223 47.722015 28.655927 26.955472
```

b)

30 random numbers from a normal distribution with mean 1 and standard deviation 2 in x.

```
set.seed(1683)
x = rnorm(30,1,2)
x
```

```
 [1]  3.55579815 -0.66954242 -2.64212053 -3.06022799
 [5]  2.76643668  1.86086078 -0.41744915  0.17610059
 [9]  1.31420282  1.60335920  3.88063856  3.13969832
[13]  3.59201919  1.18288771  0.31809168  3.54962557
[17]  1.21986016 -1.19727159 -1.15621550  1.58506331
[21]  1.78581861  0.08524394 -0.32805117  2.86333853
[25]  0.35601267 -0.81571148 -2.16379240 -1.04347455
[29] -3.61542938 -0.44138381
```

CDF probabilities of x.

```
pnorm(x,1,2)
```

```
 [1] 0.89935749 0.20192327 0.03429885 0.02117248
 [5] 0.81144084 0.66655870 0.23924771 0.34018814
 [9] 0.56241754 0.61855184 0.92511146 0.85765640
[13] 0.90251391 0.53643004 0.36656905 0.89881224
[17] 0.54376759 0.13596348 0.14049284 0.61505992
[21] 0.65280677 0.32369968 0.25333697 0.82424626
[25] 0.37372875 0.18197722 0.05683663 0.15345263
[29] 0.01050751 0.23554955
```

c)

y (poisson) of length 20 when $\lambda = 3$.

```
set.seed(1683)
rpois(20,3)
```

```
[1] 5 2 2 3 0 3 0 4 4 2 4 4 2 3 2 5 3 1 3 3
```

Question 2:

a) Roll 1 fair, six-sided die.

```
set.seed(1683)
sample(1:6,1,replace=TRUE)
```

```
[1] 6
```

b) Roll 5 fair, six-sided die.

```
set.seed(1683)
sample(1:6,5,replace=TRUE)
```

```
[1] 6 3 2 4 1
```

c) Roll 10 fair, six-sided dice and calculate their sum.

```
set.seed(1683)
sum(sample(1:6,10,replace=TRUE))
```

```
[1] 33
```

Question 3:

First we need the CDF which is given by the following.

$$F(x) = \int_0^x 2.5t^{3/2}dt = x^{5/2}$$

Then the inverse is given by

$$F^{-1}(x) = x^{2/5}$$

Now we can generate a random sample of U and apply the inverse CDF as follows.

```
set.seed(1683)
dens = function(x){2.5*x^(3/2)}
invCDF = function(x){x^(2/5)}
u <- runif(10^5,0,1)
h <- invCDF(u)
```

To verify we can check the plot.

```
hist(h,main=NULL,xlab=NULL,ylab=NULL)
par(new=TRUE)
curve(dens(x),seq(0,1),col="red",
      main="Orignal Density v.s. Histogram",
      xlab=NULL,ylab=NULL)
```